Heating with Wood in Newfoundland and Labrador

Canada-Newfoundland Conservation and Renewable Energy Demonstration Agreement

Heating with Wood in Newfoundland and Labrador

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Canada-Newfoundland
Conservation and Renewable Energy Demonstration Agreement

Our sun, wind, water and forests hold infinite energy - renewable energy - which can be harnessed for use in our industries, offices and homes. The steadily rising prices of oil and gas and the uncertainty of these fuel supplies make it profitable, even necessary, to tap our renewable resources. Yet energy savings only start here. Conservation techniques, working together with renewable energy technologies, mean further reductions in our conventional energy requirements.

Until recently, the economic and technical feasibility of many of the innovative energy techniques and technologies had not been thoroughly tested in Newfoundland and Labrador, nor in many other regions of Canada. The conditions existed for successful application of energy products and techniques. To encourage new developments and demonstrations, the federal and provincial energy departments agreed on a conservation and renewable energy agreement for each province and territory of the country.

Newfoundland's program was implemented under the **Canada - Newfoundland Conservation and Renewable Energy Demonstration Agreement (CREDA)**. The agreement, signed in June 1979, provided up to $11,250,000 over a six-year period for energy projects approved under the program. Canada's share of the costs amounted to 80 percent of the total cost and Newfoundland's share was 20 percent of the total.

The end goal of this development and demonstration program is to encourage successful application of innovative technologies. The data from these projects has been collected and information on performance and cost of the various energy systems in this province is now available.

This book presents a summary of the information available on just one of our renewable resources.

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Introduction

With proper care our forests can provide an abundant renewable source of wood for fuel. Wood is an important source of heat for a majority of homes in Newfoundland and Labrador. And many more homes have a fireplace where wood is burned for pleasure. Our traditional view of woodburning is that it is hard work. Every couple of hours you have to push another couple of junks into the fire for as long as you want heat, but there are easier ways.

In this book, the basics of woodburning are explained. Cutting, storage, appliance selection, installation and operation are all covered. At the back of the book are a number of technical profiles for residential woodburning projects completed in this province. Some different types of burners which reduce the amount of labour are also discussed. These include a heat storage fireplace, a woodchip burner and woodwaste burner.

There is a wide range of woodburning appliances on the market and quite a few suppliers. By investing in time-tested, dependable equipment, you can look forward to years of inexpensive heat.

Combustion

Energy from the sun is stored in the cells of a tree as it grows. This accumulated matter is called biomass. The most straightforward way of obtaining energy from biomass is by combustion.

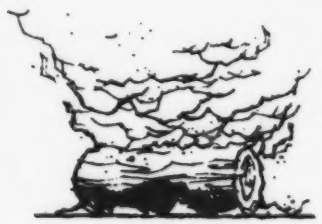
The stages of wood burning are shown below. It is important to remember that wood burns differently at different temperatures.

If the temperature is too low, burning wood produces dangerous creosote and unhealthy gases. However, if wood is burned hot enough, it is a cleaner fuel than oil.

The two main ways to achieve complete combustion are to burn hot, with lots of air, or to burn the flue gases with extra air in a secondary chamber.

The signs of incomplete combustion are soot and creosote. Creosote is a fog of gases and unburned tar-like liquids which condenses on cool surfaces.

The Four Stages of Burning Wood



over 100 °C	Heating/Drying	The wood is heated to kindling temperature and excess moisture is boiled off. Another source of heat, usually kindling, is required at this stage.

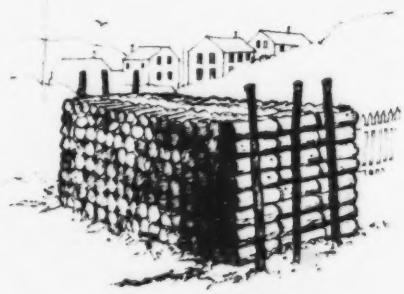
300 °C to 600 °C	Gases and liquid droplets driven out (Incomplete combustion)	The gases and droplets are what actually burn at this stage. ⅓ to ⅔ of wood's energy is in gases and tar. Heat drives these out; if they are driven out without being burned, they will go up the chimney, wasting the energy in the wood, polluting the air and leading to creosote deposits.

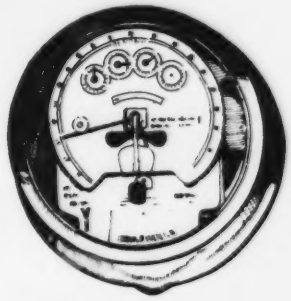
600 °C	Gases start to ignite	The more gases burned the more complete the combustion. Lots of air is required.

800 °C	Charcoal burns (Complete combustion)	Charcoal is the material remaining after the gases and other products are driven off. It burns very cleanly, leaving few ashes.

Wood Requirements

Total Energy Content: One Cord of Wood = 500 Litres of Oil = 5300 kWh of Electricity





Available Energy Content: (depends on efficiency) One Cord of Wood = 380 Litres of Oil = 2700 kWh of Electricity

Wood requirements can be estimated from present oil or electricity use, by comparing the heating values of oil, electricity and wood. The heating value depends on the thermal content of the fuel, and on the efficiency of the burner.

Thermal Content

The thermal content of wood depends on the density of wood and its moisture content. Average values for various species at 20% moisture content are shown in the table.

Average Heating Value Per Cord of Dry Wood

Wood Species	Thermal Content per cord (million kJ)
Birch	25.0
Tamarac (Larch)	24.3
Spruce	19.2
Aspen (Poplar)	17.4
Fir	17.3
Pine	17.3

These values must be reduced by about 10% for green wood.

Efficiency

The actual amount of heat produced depends on how efficiently the stored energy is converted to heat.

$$\text{Efficiency} = \frac{\text{useful heat produced}}{\text{energy content of wood}}$$

For estimating wood requirements based on present fuel use, typical efficiencies can be taken as

oil furnace	65%
electric heater	100%
modern wood stove	50%
complete combustion wood burning unit	80%
fireplaces	5%

Heating Value When Burned

Using the typical efficiencies given above, the heating values of the three fuels can be compared. Consider 2 types of wood burners, one a modern stove with 50% efficiency, the other a complete combustion unit with 80% efficiency.

A home burning 4500 ℓ of oil per year would need 11-12 cords of wood to completely replace the oil, with a 50% efficient stove. With an 80% efficient stove or furnace, the amount is reduced to just over 7 cords.

In fact, heating habits often change when a wood stove or furnace is used. Typical St. John's home consumption is about 5-6 cords per year in an ordinary furnace. Labrador use is about 10 cords per year.

Fuel Wood

Sources of Wood

Roundwood and splits may be purchased from dealers or cut by the homeowner. Dealers can be found from advertisements in newspapers and in the yellow pages, or they may come to your door.

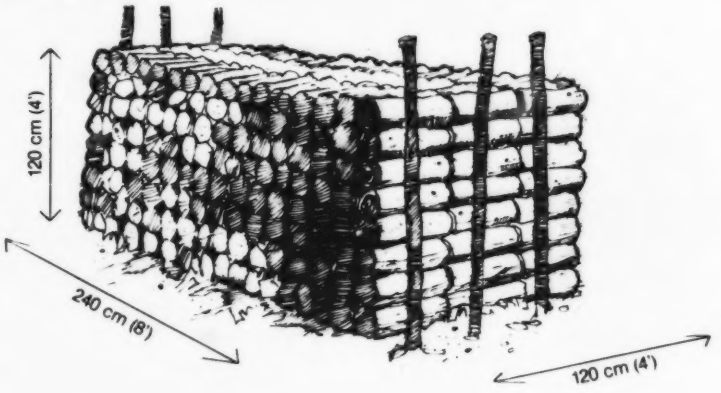
Measurement of wood fuel is usually by the cord or by the number of pieces or junks. The solid wood content of one cord is 2.1 to 2.6m³ or approximately 2 tonnes. On average, a cord of wood is equivalent to about 350 15cm diameter junks 60cm long.

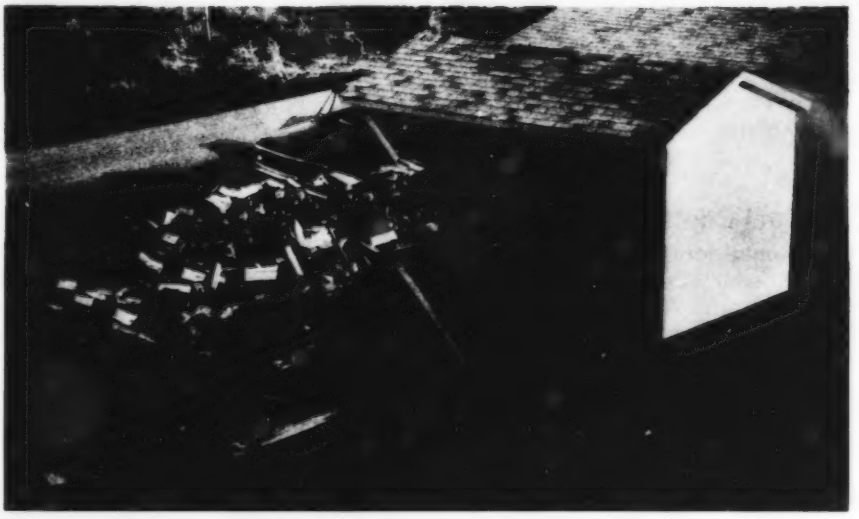
Try to look at the wood before agreeing to purchase it. The size of the junks can vary greatly. They must be small enough to fit the stove, unless you are prepared to cut and split them.

For those who prefer to cut their own wood, local forestry units will provide permits to cut from Crown land. The forestry units are listed in the telephone book under the Provincial Department of Forest Resources and Lands, Forest Management Unit Office. Unit foresters can also give advice on training and safety for the inexperienced.

Cutting and splitting wood is hard work and it can be dangerous. Nevertheless, three quarters of the people who burn wood in the province do cut their own.

Dimensions of One Cord of Wood





An open shed is an ideal place to dry and store wood.

Drying and Storing Wood

The heating value of wood fuel varies with its moisture content. If the wood is green, about 10% of the heating value will be lost. When wet wood burns, energy is used just to drive off excess moisture; if the wood is dried ahead of time and kept dry, this energy will not be wasted.

More heating value will be lost if the wood starts to rot. The fungi which cause the rot use up the wood's energy, so that there is less left when it is burned.

The rules for drying and storing wood are

- Buy or cut well in advance of use, e.g. a year ahead.
- Keep it off the ground to prevent rot.
- Dry in the summer.
- Do not dry it indoors. Moisture problems in the rest of the house will result.
- Once it is dry, keep it covered. A separate shed or lean-to is ideal. Plastic covers do not last long in the wind.
- Long wood can be stacked like a teepee to dry. No cover is required because rain will run off the bark and will not be absorbed by the wood itself.

Wood Burning Appliances

There are three main categories of wood heaters: fireplaces, stoves and furnaces. The choice depends on how the heater will be used.

Efficiency of Woodburning Appliances

As discussed in the section "Efficiency", efficiency is a measure of how much of the available energy is produced as heat when wood is burned in an appliance.

It depends on a number of factors, most importantly on how complete the combustion is and on how much of the heat from the fire gets transferred to the room.

Unfortunately, the two do not always go together. More complete combustion results from a short, hot fire with lots of air, but better heat transfer may result from a low fire using much less air.

However it is possible to get both. For optimum efficiency, look for
- A hot-burning unit with heat storage, or
- A stove with a secondary combustion chamber or some other way of using the flue gases, such as a catalytic combustor. (See the section "Types of Stoves.")

Heat from a fireplace is usually stored in a mass of masonry; in a furnace it is often stored in a large, well-insulated hot water tank.

Stoves with secondary combustion chambers or catalytic combustors provide good heat transfer from a long slow fire, yet burn the gases as well.

The next few pages describe these and other common types of fireplaces, stoves, and heaters.

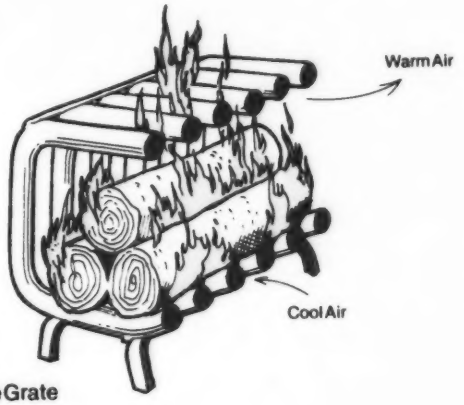
Fireplaces

Generally, ordinary fireplaces have efficiencies of about 0 - 10%. More heat can be obtained from an existing fireplace by making a few simple alterations, such as adding a tube grate or installing a fireplace insert.

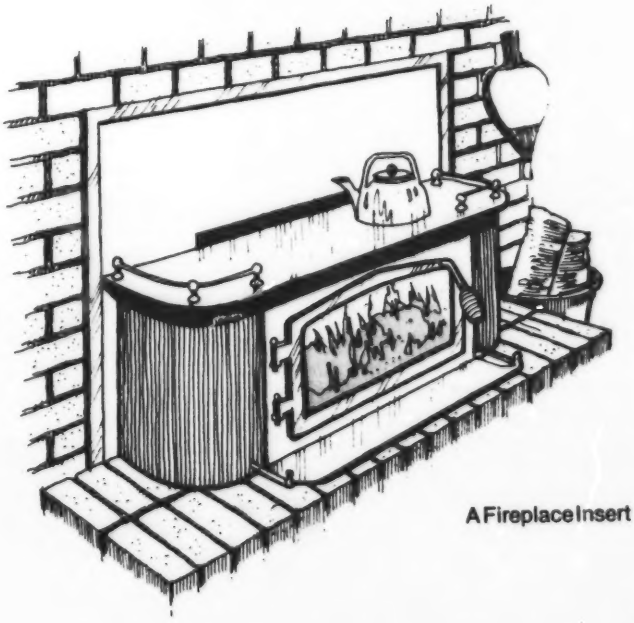
New fireplaces with heatliner/duct systems or heat storage systems can have efficiencies of 50 - 80%.

If there is sufficient space for the extra masonry required, hot-burning heat-storage fireplaces are an excellent idea. A short hot fire heats the masonry, which then warms the room for up to 12 hours after the fire has burned out.

The advantages over conventional stoves include
- much less stoking
- greater safety, especially for children, as the surfaces are warm rather than hot
- more complete combustion, requiring less wood and causing less pollution, creosote and ash.



A Tube Grate


A Fireplace Insert

Wood Stoves

Wood stoves, although originally used for both cooking and heating, are now used primarily for space heating and hot water supply. Some of the common types of stoves are described below.

Types of Stoves

Airtight and Non-airtight Stoves

Most modern stoves are airtight. They control combustion by controlling air intake. Non-airtight stoves are similar to fireplaces in that they have uncontrolled airflow and therefore uncontrolled combustion.

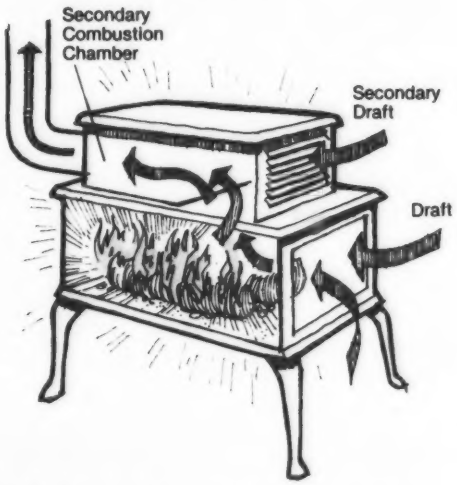
An important feature to look for in an airtight stove is the capacity to burn flue gases. To get a long slow burn (e.g. overnight), the air intake in modern airtight stoves can be significantly reduced. But without sufficient air, the fire is not hot enough to burn the wood gases.

Some ways to encourage more complete combustion in an airtight stove are to

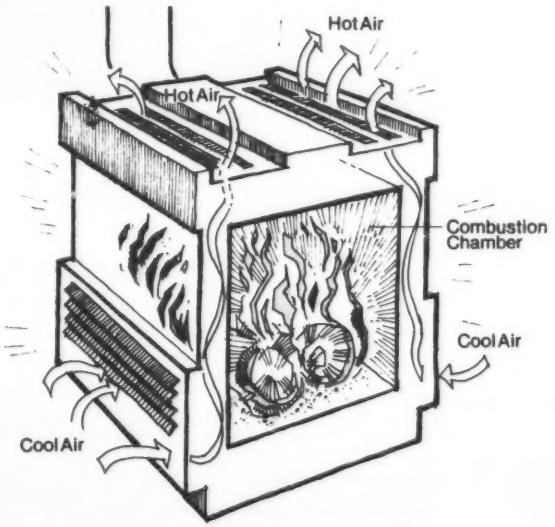
- ensure high temperatures in the firebox by using an insulating brick liner, and by insulating the flue pipe.
- choose a stove with a secondary combustion chamber. Extra air is brought in to burn the flue gases without affecting the main fire.
- use a catalytic combustor. A special metal coating on a filter-type unit causes the gases to ignite at a lower temperature than normal. Note that the instructions for using these must be carefully followed, otherwise they don't work.

Radiant and Circulating Stoves

The two types of modern airtight stoves are known as radiant and circulating. There is no particular advantage of one type over the other although circulating stoves are safer because the surfaces are not as hot. Because less clearance is required around them, they may also be useful in small spaces.



Radiant Stoves transfer heat by radiating heat from the hot surface.



Circulating Stoves circulate hot air through vents by convection or by a fan.

Prices of Woodstoves

Prices (without installation) range from $300 to $1600 (1984). There is no tax on woodstoves.

Government grants to cover part of the cost are still available in some cases. Check with federal and provincial departments of energy on the status of these grants.

Choosing the Right Size of Woodstove

The size of the woodstove depends on the area to be heated and the overall heat loss from the house.

Although retailers and manufacturers will offer advice, it is very important to talk to people heating houses similar to yours with wood. Find out what size of stove they have, and whether they are satisfied with it.

A common complaint about wood stoves is that they make the room too hot. This may be because the stove is too large. In general, a stove that is a bit too small is preferable to one that is a bit too large. Short hot fires in a small stove will still provide good heat, with less creosote and less pollution.

Locating the Stove

The location of a wood stove will be determined by safety regulations, and by the desired heat distribution.

The safety regulations are discussed in the section "Safety". There must be enough space around the stove to provide the required clearances, and the chimney connector (flue pipe) must not be more than 3m long.

The desired heat distribution is the other major consideration in choosing a location. Some guidelines are

- Put the stove where the heat is needed most. A central location is usually best.
- If other rooms need heat, registers at floor and ceiling level will help circulate the warm air.
- Do not put the stove in the basement unless the basement is well-insulated and used on a regular basis. Too much heat will be lost to the basement walls and floor.

Furnaces

Wood burning furnaces are suitable for heating a large area with a number of rooms. A furnace is similar to a wood burning stove, except that the heat is circulated through the house by hot air vents or hot water radiation.

As with a stove, the main problem is that the furnace must be stoked every few hours. Some combi-furnaces have been developed which have an oil burner or electric heater in addition to the wood burning chamber. An automatic control switches to oil burning or electric heat if the wood fire is too low.

Heat-storing, hot-burning furnaces are now available; they use less wood, burn most of the creosote and gases, and need stoking less often. They are also simple, safe and convenient, but unfortunately are expensive.

These furnaces generate maximum heat from the wood in a hot fire and then store it in a well insulated tank of hot water for later use.

Prices of Furnaces

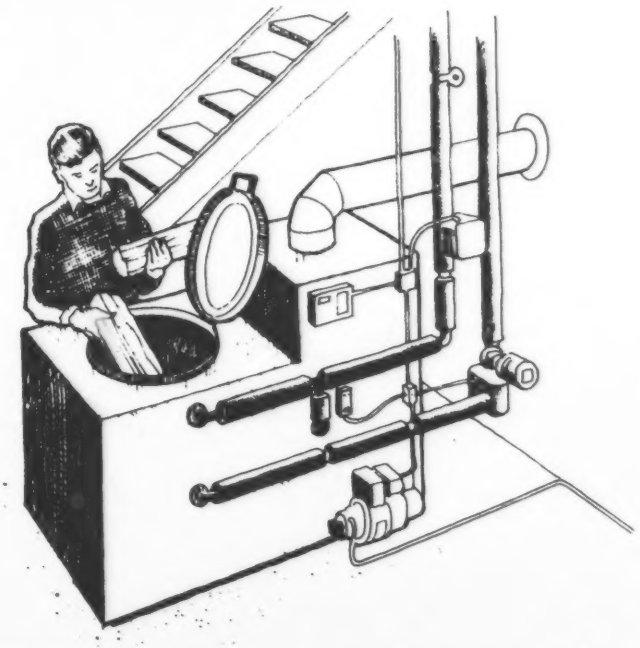
A wood-burning furnace can cost slightly less than an oil-fuelled warm air furnace. Combi-furnaces cost a bit more. Typical 1984 costs installed are:

Wood only	$1 250
Oil only	$1 500
Combi (wood/oil or wood/electricity)	$1 800
Heat storing (burner + tank)	$5 000 and up

As with wood stoves, government grants may be available to offset part of the cost.

Choosing the Size of Furnace

The heat output of a satisfactory existing furnace is often a good guide to the required size of wood furnace. Manufacturers will provide advice on sizing for both new and existing homes.



A heat-storing furnace is more expensive than a conventional wood furnace, but it requires much less stoking and burns much cleaner. The pipes lead to a large hot water tank.

Economics

Most people burn wood in preference to other fuels in order to save money. The amount saved depends on how much is presently spent on fuel, and to what extent wood will replace it.

The following information is required to calculate the savings:
- Present fuel costs.
- Percentage of oil or electricity to be replaced by wood use.
- Cost of an equivalent amount of wood.
- Cost of wood heater and chimney (installed).

The payback period is often calculated to decide whether or not a system is worthwhile. This is the time it takes for the savings to repay the initial cost.

Simple
payback period = total capital cost / savings/year

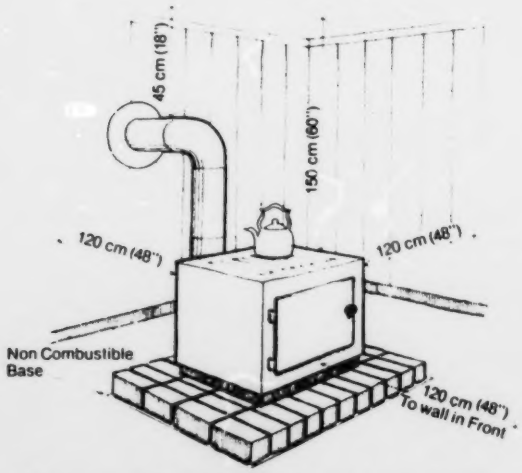
Example: Is it worth buying a heat storing furnace to replace 4500 ℓ of oil presently burned? Assume a new chimney is required.

a)	Present Use	4500 ℓ (1000 gal) oil/year
b)	Replace	90% x 4500 ℓ = 4050 ℓ (890 gal)
c)	Saving in oil	4050 ℓ x 37¢/ℓ = $1499
d)	Oil contains	38.7×10^3 kJ/ℓ
e)	Oil burner efficiency	65%
f)	Heat from oil	38.7×10^3 kJ/ℓ x 4050 ℓ x 65% = 102×10^6 kJ
g)	Wood contains	19.2×10^6 kJ/cord
h)	Wood burner efficiency	80%
i)	Wood required	$\frac{102 \times 10^6 \text{ kJ}}{19.2 \times 10^6 \text{ kJ/cord} \times 80\%}$ = 6.7 cords
j)	Cost of wood	6.7 cords at $60/cord = $402
k)	Savings per year	$1499 − 402 = $1097
g)	Cost of furnace	$4000
	+ heat storage tank	$2700
	+ chimney	$1600
		TOTAL $8300

Simple payback period = $\frac{\text{cost of equipment}}{\text{savings/yr}} = \frac{\$8300}{\$1097} = 7.6$ yrs.

This means that after 7.6 years, the savings will have paid off the cost of the stove. If the price of oil goes up, or if a government grant helps reduce the initial cost, the payback period for the homeowner is even shorter.

Safety



Recommended clearances around a radiant wood stove. (Can be reduced by adding shielding.)

Installation

A wood stove or furnace must be installed properly. Regulations concerning the installation of wood burning stoves and furnaces should be followed to the letter.

Insurance companies, the Canadian Standards Association, the Wood Energy Institute, Underwriter's Laboratories of Canada, Canada Mortgage and Housing Corporation and the Fire Commissioner's office can all provide relevant information.

In general, woodstoves approved by the Canadian Standards Association have a label showing required clearances and allowable temperatures around the stove. Typical clearances are shown. The dealer can usually arrange for installation.

Chimneys

Chimneys are required to carry away smoke and to create the draft needed to supply air to the fire.

The best chimneys are either prefabricated, insulated metal, or masonry lined with stainless steel or refractory tile, insulated between liner and masonry. To be safe, prefabricated chimneys must be certified by the Underwriters Laboratory of Canada (ULC) for use with wood burning appliances.

If an existing chimney will be used, check with the stove manufacturer and the Fire Department to make sure it is safe. In old houses, a tile or metal liner will probably be required.

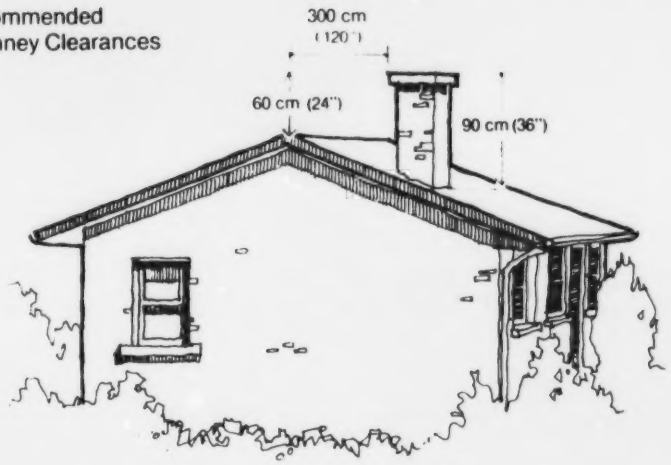
Creosote

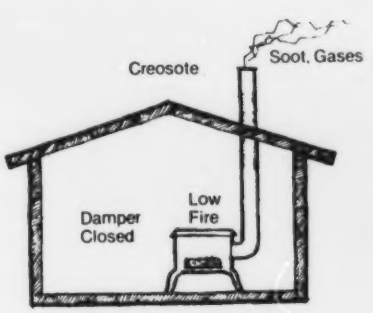
Creosote buildup is dangerous because the creosote can suddenly ignite and cause a fire in the chimney. It is also corrosive.

With units capable of providing complete combustion, creosote production will be low and much less of a problem. Even in an ordinary stove, creosote buildup can be reduced in a number of ways.

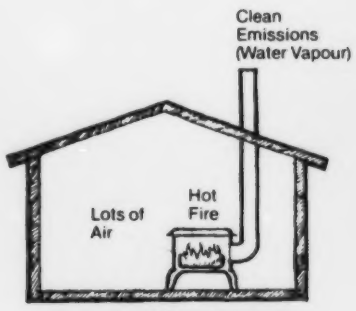
- Use dry wood.
- Avoid smouldering fires. Keep the air intake open, and pile wood loosely to allow circulation. If this extra air requirement causes drafts in the room, they can be reduced by providing air near the stove, e.g. by installing a vent or opening in the floor near the stove to allow air to be drawn up from the basement.
- Let the fire burn hot for at least 20 minutes every day.

Recommended Chimney Clearances





Incomplete Combustion



Complete Combustion

- Build as much as possible of the chimney indoors and insulate it. Creosote condenses on cool surfaces, so insulate the stove pipe where it leaves the firebox to encourage hot fires, and make sure it slopes up steeply. Liquid creosote will then run back down into the stove, where it will burn safely.

To be safe, inspect and clean your chimney often. This could be as often as every few weeks. A buildup of creosote of more than 6 mm is dangerous.

Safety Rules

With any wood burning appliance, vigilance is essential. Some safety rules are:

- Install a fireguard around a radiant stove.
- Keep wood, furniture, newspapers, and other combustibles at least 1.2m from the stove.
- Do not dry green wood on the stove.
- Keep the chimney clean.
- Never start the fire by using flammable liquids.

If a stove is properly installed, and if it is used and maintained carefully, risks are minimized.

A bulletin on wood burning may be obtained from the Office of the Fire Commissioner, Provincial Department of Justice.

Summary

Before the decision to switch to heating with wood is made, the long- and short-term advantages and disadvantages should be carefully weighed.

Advantages	Disadvantages	Suggestions
- Wood burning can save money and provide a feeling of self-reliance.	Frequent stoking necessary	Get a hot-burning stove or furnace which stores heat. Install combi-furnace or backup system.
- A non-renewable resource (oil) is being conserved.	More work (cleaning, maintenance, splitting, feeding fire)	You can't avoid this one, but you can - store wood conveniently. - buy wood already split, and kindling in bundles. - reduce stoking by using a heat-storing unit.
- A local energy industry is being encouraged.	Need for cutting and storage space	Build a simple shed or lean-to.
	Pollution: air	Aim for complete combustion.
	noise (chain saw)	Do most of cutting in woods away from residential areas. Be considerate in choosing a time to cut.
	Fire risk	Be careful! Install smoke detectors and fire extinguishers. Inspect chimney often. Observe clearance and other regulations to the letter.

Air Pollution

Anything that reduces creosote build-up also reduces air pollution. Soot and gases escaping into the air can be a serious health hazard. Be careful what you burn, because coloured paper, plastics and other materials can release dangerous products into the air, both inside and outside the home.

Insurance

Due to the additional fire risk associated with wood burning appliances, household insurance may be affected. Some insurance companies refuse to insure homes with wood burning appliances, some increase rates 20% to 50% and some make no change at all. Check with your insurance company about policies.

Example Projects

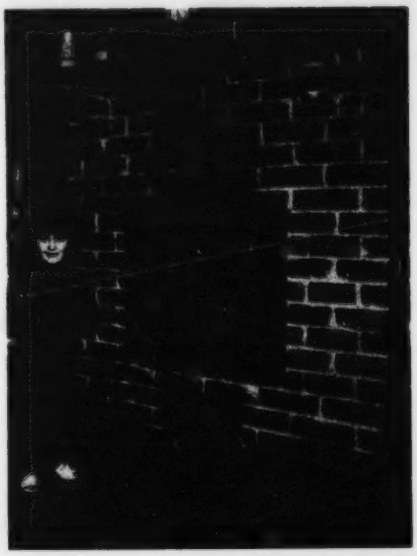
Project Name: Finnish Fireplace
Paradise, Newfoundland

Description: The owner has had a Finnish Fireplace built in his home. The fireplace uses a downdraft contraflow concept. Hot gas moves up a central fire tube, then is forced down on either side of the firebox where the heat is released to the exterior brick shell. The cooled gases enter a secondary combustion chamber, are burned further and then released from the chimney flue. As the warm air moves down and out of the fireplace, cool air flows in causing a circulation flow in the living space. Once the burn is complete dampers are closed. The brick shell continues to radiate heat for up to 24 hours.

Costs: (1984)		
	Capital	$3 160
	Installation	$3 550
	Total	$6 710

Savings: The owner estimates that the fireplace will reduce his annual fuel costs from $1 400 to $300 giving an overall annual saving of $1 100.

$$\text{Payback period} = \frac{\$6\ 710}{\$1\ 100} = 6.1 \text{ yrs.}$$



This Finnish fireplace burns hot and efficiently, yet radiates heat slowly and safely.

Project Name: Domestic Woodchip Heating
Various locations in the province.

Description: In a typical set-up, the homeowner installed a gravity feed preheater (Precision Products' Firefly Model) attached to a conventional hot air wood furnace. An insulated refractory tunnel conveys hot gases from the preheater to the heat exchanger. The system is connected to a newly installed high temperature pre-fab chimney. Operation requires manual loading of the hopper from twice a day to once every two days depending on season and heating load.

Costs: (1983)		
	Capital	$3 330
	Installation	$ 997
	Total	$4 297

Savings: The owner estimates that fuel costs will be reduced from $1204 for oil to $525 for woodchips plus $86 of oil (used for backup). Annual savings are $593.

$$\text{Payback period} = \frac{\$4\ 297}{\$\ 593} = 7.3 \text{ yrs.}$$

Woodchip heating is convenient because the chips are fed automatically from the hopper to the pre-burner. Supply and storage of chips can be a problem, however.

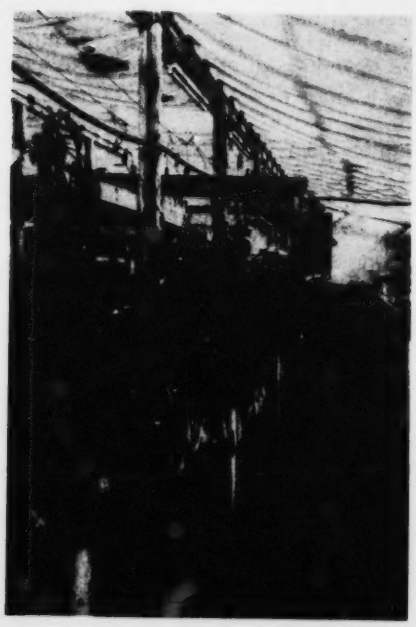
Project Name: Hahsa Burning Plant
Cormack, Newfoundland

Description: The owner-built heating plant is designed to heat a residential or small commercial property. In this case, it is being used to heat a commercial greenhouse. The unit burns a variety of fuels including wood waste, paper and woodchips. In this project, wood slabs are used as they are cheap and easy to obtain, supplemented by hardwood when necessary.

Costs: (1984)		
	Capital	$6 125 (Excluding owner's labour)
	Installation	$ 800
	Total	$6 925

Savings: The owners estimate that using an oil furnace would cost $12 000 a year. The estimated cost of wood fuel is $500 per year. An additional $500 a year should take care of additional expenses related to fuel collection such as snowmobile or chainsaw repairs. Thus savings are $11 000.

$$\text{Payback period} = \frac{\$\ 6\ 925}{\$11\ 000} = 0.6 \text{ yrs.}$$



The building on the left houses a hot burning furnace, covered with sand. Hot water pipes in the sand carry the heat to the greenhouse.

Project Name: Oil to Wood Conversion (Manufacturing)
Wallken Enterprises,
Topsail Road, St. John's, Newfoundland

Description: This enterprise produces factory built homes and building components. Considerable waste wood is available as sawdust and scraps from the manufacturing processes.

A batch loading furnace with hot air distribution was installed to provide heat to the 2600 m² building. A conveyor belt delivers scraps to a collection area adjacent to the furnace.

Costs: (1981)	Furnace, installed	$17 900
	Ducting, installed	$10 500
	Other (materials, labour, tax, freight, etc.)	$32 600
	Total	$61 000
Savings:	Previous oil consumption	$21 100
	Wood cost (in addition to available waste)	$ 8 600
	Savings	$12 500

Payback period = $\frac{\$61\,000}{\$12\,500}$ = 5 yrs.

Wallken Enterprises saves money by burning their wood wastes.

Project Name: Conventional Domestic Wood Furnace
St. John's, Newfoundland

Description: In this typical installation, a wood furnace is used to supply about 50% of the heat for a 170 m² (1800 ft²) home. The hot air system required some new ductwork as well as a new prefabricated insulated chimney was required. Electric baseboard units provide supplementary heat. About 4 cords of wood per year are burned, at a cost of $60/cord delivered.

Costs: (1984) Capital (Furnace, ductwork and chimney) $2 000

Savings: The owner estimates savings of about $600/per year.

Payback period = $\frac{\$2\,000}{\$\ 600}$ = 3.3 yrs.

References

There are many excellent references on wood energy. The books and government publications listed below are available from the library of the provincial Department of Mines and Energy. The periodicals may be obtained through libraries.

Books

Clegg, P., *Energy for the Home*, Garden Way Publishing, Charlotte, Vermont, 1975.

Energy Probe, *Energy Sources for Today*, Tutor Press, Toronto, Ontario, 1978.

Shapiro, A.B. and Shelton, J., *The Woodburners Encyclopaedia*, Vermont Crossroads Press, Waitsfield, Vermont, 1976.

Stoner, C.H., *Producing Your Own Power*, Rodale Press Inc., Emmaus, Pa., 1974.

Government Publications

The Bill Payer's Guide to Home Heating. Energy, Mines and Resources Canada.

Heating with Wood. Energy, Mines and Resources Canada.

Heating with Wood - Safely. Canada Mortgage and Housing Corporation.

McCallum, B., *Environmentally Appropriate Technology*. Fisheries and Environment Canada, 1977.

An Old Flame Rekindled. Ontario Ministry of Energy.

The Wood Book. Nova Scotia Department of Mines and Energy.

Information may also be obtained from:
The Canadian Wood Energy Institute
85 Curlew Drive
Don Mills, Ontario M3A 2P8
Tel. 416-445-6296

Visual Material

National Film Board of Canada
Provincial Department of Mines and Energy

Suppliers

There are numerous suppliers of fireplaces, wood stoves and furnaces. Department and hardware store catalogues list many. Heat-storing fireplaces and wood furnaces are less common. Some suppliers of these include:

Fireplaces

Finnish Fireplace
Local Representative:
Martin's Masonry & Ceramic Tiles Ltd.
143 Forest Road
St. John's, Nfld.
A1A 3T3
Tel: 722-4465

Other suppliers of heat-storing masonry fireplaces are listed in *Harrowsmith* #53 Feb.-March 1984

Furnaces

HAHSA Company
R.D.#1, Box 311
Falls, PA 18614

Jetstream
Kerr Controls Limited
P.O. Box 1500
24 Court Street
Truro, Nova Scotia
B2N 5V2
Tel: 902-895-9281
Local Distributor:
Cyril Folkes
55 Southcott Drive
Grand Falls, Nfld.
A2A 2P2
Tel: 489-3393

Tempest
Dumont Industries
P.O. Box 148
Monmouth, ME 04259
Nova Scotia Representative:
Scotia Farm Services
Box 501
Kentville, N.S.
B4N 3X3
Attn.: Don Petipas
Tel: 902-678-7797